Additional Rescue Stent Placement for Stabilization of a Prolapsed Coil during Stent-assisted Coil Embolization of a Wide-Neck Intracranial Aneurysm

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Summary

We report a case of a 55-year-old man carrying two unruptured internal carotid artery (ICA) wide-neck aneurysms.

In the same session, the smaller aneurysm was treated by coils using the remodeling technique and the large aneurysm was treated by stent-assisted coil embolization. During the stent-assisted procedure for the large aneurysm, the microcatheter tip moved from the aneurysm into the parent artery causing a prolapse of some coil loops into the vessel lumen.

The distal part of the coil was tangled within the stent's struts, therefore, in order to introduce the entire coil, an attempt was made to withdraw the prolapsed loops of the coil within the microcatheter and concomitantly repositioning the microcatheter into the residual aneurysm neck through the stent struts. However this maneuver was unsuccessful.

An attempt to retrieve gently the coil also failed and the coil prematurely detached. For maintaining the patency of the arterial lumen and to reduce the embolic risk, a second stent was used to pin the free coil loops. The rescue stent was positioned within the coil loops and its deployment allowed a circumferential expansion of some loops around the stent perimeter while other loops were flattened against the wall of the artery. The parent artery remained patent at one-year follow-up angiographic study. No clinical complications were observed.

Introduction

Until recently, patients with wide-neck aneurysms were not considered good candidates for endovascular treatment due to the high risk of coil migration responsible for neurological complications and the high incidence of aneurysm re-canalization [1]. Improvements in endovascular technology, including development of intracranial stents and coated coils, allow now treatment of wide-necked large aneurysms [2-5]. New embolization technologies can be used successfully even in more complex aneurysms with low acceptable morbidity and mortality [5-12]. Even though, in some instances, wide-necked large aneurysms remain difficult to treat by endovascular procedures and complications related or associated with new techniques including stenting have been reported [7-12].

During peri-procedural complications of intracranial aneurysm treatment, the use of a stent as an endovascular rescue tool has been reported in few papers [13-16]. We report a case of a large aneurysm treated by stent-assisted coil embolization technique in which a complication with potential morbidity due to a floating coil within the parent artery was solved using an additional rescue stent.

Case report

An asymptomatic 55-year-old man with a history of headaches was referred for clinical evaluation. After examination by his primary care physician, a magnetic resonance imaging (MRI) and angio-MRI were performed and revealed two left ICA segments aneurysms. The patient had no documented history of hemorrhage from these aneurysms and his neurological examination was normal. An angiographic study confirmed the presence of a left carotid siphon aneurysm with a maximum diameter of 18-mm and a small aneurysm of the left anterior choroidal artery. After patient informed consent, endovascular therapy was scheduled for both aneurysms.

The endovascular procedure was performed under general anesthesia. Systematic anticoagulation was administered with a bolus of 5000 U heparin, followed by a heparin infusion to maintain an activated clotting time (ACT) around 250 seconds. Using a femoral approach a 6F Envoy guiding catheter (Cordis Endovascular, Miami Lakers, FL) was positioned in the Internal Carotid Artery (ICA). The choroidal-ICA aneurysm was treated first by coiling with remodeling technique. Then the large carotid siphon aneurysm was treated by stent assisted-coiling technique. A 4.5 x 25 mm self expandable Leo stent (Balt, Montmorency, France) was deployed in the artery lumen covering the whole neck of the aneurysm. Then catheterization of the aneurismal sac through the stent struts was performed using a Vasco 18 microcathether (Balt, Montmorency, France) with a 0.016-inch micro guidewire (Terumo, Boston, MA). The first coil allowing a correct basket was a 3D Matrix detachable coil (Boston Scientific, Freemont, CA). Then the other coils for filling the aneurysm were 2D Matrix coils. In total, 14 coils (total length, 305 cm) were deployed. Towards the end of the procedure, because the aneurysm neck was still permeable, we re-catheterized the aneurysm through the stent struts with a smaller microcatheter (Vasco10, Balt, Montmorency, France).

The change of the microcatheter was performed because the residual part of the aneurysm was small and the delivery of a coil 10 through a catheter 18 can increase the risk of unravel or coil fracture. During the placement of a soft GDC 10 coil (2 mm x 6 cm), the microcatheter kicked back into the arterial lumen with the proximal part of the coil prolapsing within the parent artery and the distal part remaining inside the aneurysm. The distal part of the coil was also tangled to the stent's struts, therefore, in order to introduce the entire coil, an attempt was made to withdraw the floating loops of the coil within the microcatheter and concomitantly repositioning the microcatheter into the residual aneurysm neck. However this maneuver was unsuccessful. An attempt to retrieve gently the coil also failed and the coil prematurely detached. An attempt to retrieve the coil with a 2.5-French Retriever-10 endovascular snare (Boston Scientific/Target) was stopped because it showed movements of the stent and the intraneurismal mass of coils confirming that the prolapsed coil was attached to both the stent's struts and the coil mass. In order to maintain the patency of the arterial lumen and to reduce the embolic risk, a second rescue 4.5 x 20 mm self expandable Leo stent (Balt, Montmorency, France) was used to pin the free coil loops. The Vasco 21 microcatheter carrying the stent was positioned within the center of the free coil loops. It was not possible to place the stent-system more distally because of the difficult anatomical configuration. In addition, the microcatheter tented to move the first stent.

The deployment of the rescue stent allowed a circumferential expansion of some loops around the stent itself while the other loops were flattened against the arterial wall. There was a slight overlapping of the two stents. The control angiograms showed patency of the ICA and no more coil loops were floating within the arterial lumen (figure). Heparinization (twice the baseline) was continued during 24 hours and groin puncture site homeostasis was achieved with an Angioseal device (Sherwood, Davis, and Geck, Bothell, WA). Antiplatelet therapy was instituted with Clopidogrel (Plavix; Sanofi Pharmaceuticals, New York NY) 75 mg/day for six months and aspirin 150 mg/day for one year. Neurological examination was normal.

Control MR study including FLAIR and diffusion weighted images performed 48 hour after the procedure showed no lesions. Follow-up angiograms performed respectively at six months and one year showed that the herniated coil remained pinned to the wall of the vessel by the second stent with persistent patency of the ICA and no post-stenting stenosis (fig-

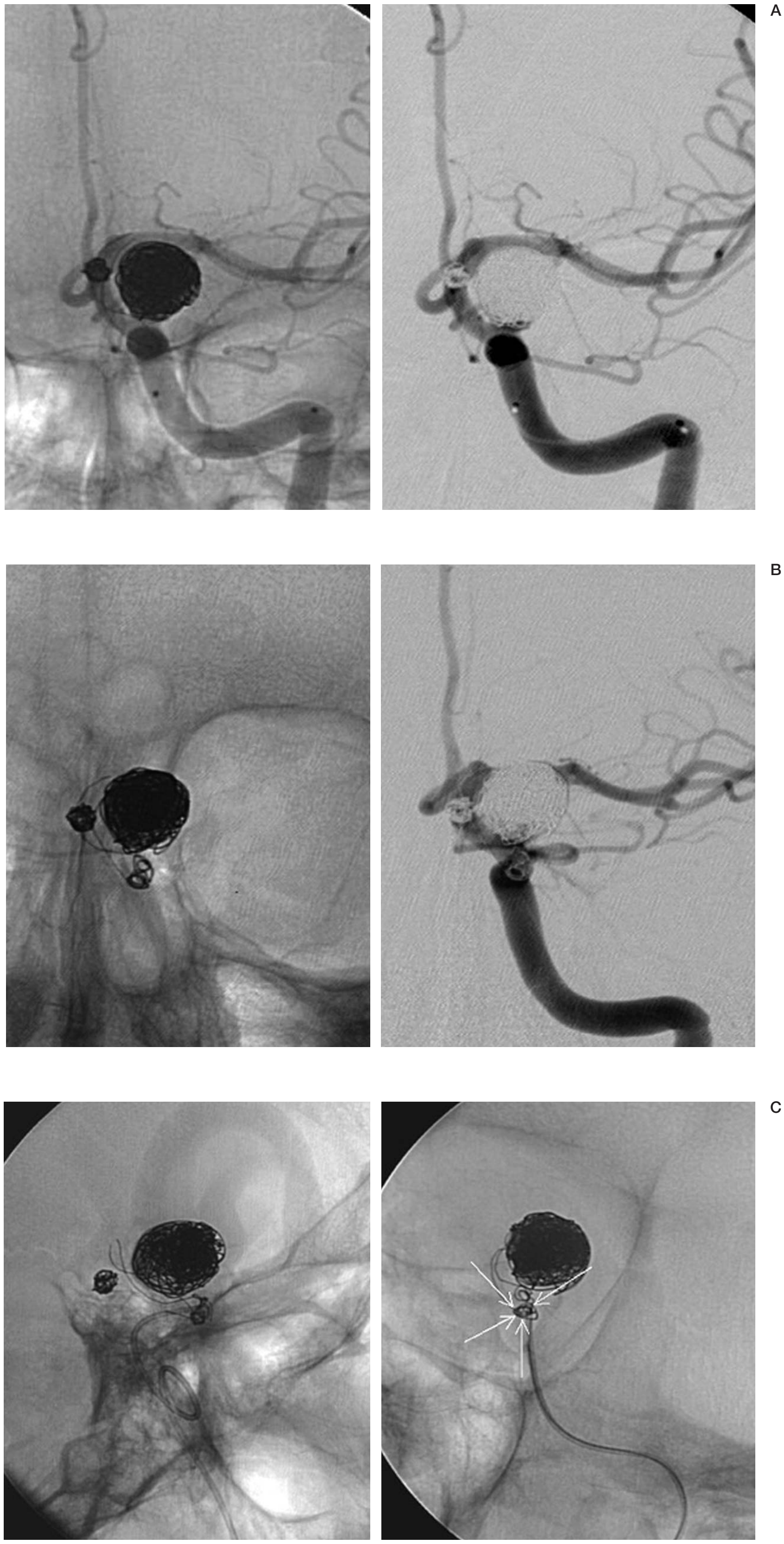

Figure 1 Additional stent placement for stabilization of a floating coil during endovascular treatment of a wide-neck intracranial aneurysm in a 55-year-old patient. A) Non-subtracted and subtracted left Internal Carotid Artery (ICA) angiograms in Antero-Posterior (AP) view show an intermediate step of a Stent-assisted Coil Embolization of a large unruptured aneurysm of the carotid siphon. The image also shows a small anterior choroidal aneurysm formerly treated by coiling with balloon remodeling technique in the same session. During placement of another coil, the microcatheter kicked back in the arterial lumen (not shown) and the maneuvers for repositioning the microcatheter caused coil premature detachment. B) Same views as in (A), some distal coil loops are entangled within the stent mesh and proximal loops freely float in the artery lumen at the proximal extremity of the stent. C) Before the deployment of the rescue stent, working non-subtracted and non injected oblique views show the positioning of the tip of Vasco 21 microcatheter within the center of the prolapsed coil mass.

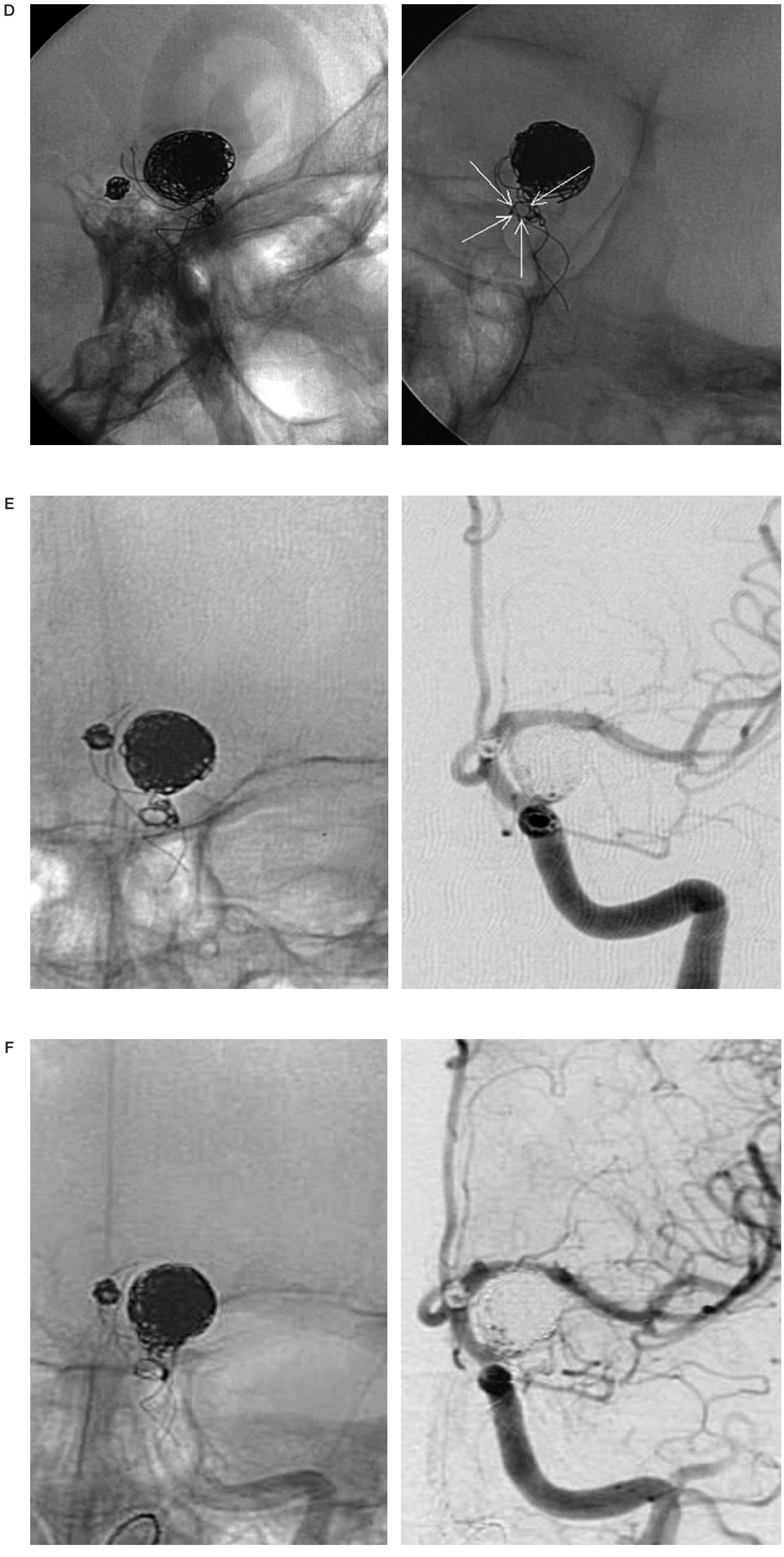

Figure 1 D) Same views as in (C), after the deployment of the rescue stent, circumferential spread of some free coil loops around the stent is observed (arrows). There is a slight overlapping of the two stents. E) Non-subtracted and subtracted left ICA angiograms in AP view show the patency of the artery lumen. Some pinned up coil loops look like a ring around the rescue stent which has now a diameter adapted to the arterial lumen and the rest of the free loops are flattened against the arterial wall. F) Same views as in (E), one year follow-up angiogram during re-treatment of aneurismal recurrence shows persistent patency of the ICA with no post-stenting stenosis. The patient remained asymptomatic.

ure). The patient was retreated for recurrence of the large ICA aneurysm one year after the first endovascular procedure. The neurological examination remained normal at 18 months follow-up.

Discussion

New endovascular techniques including stenting and newer generation of coils permit the treatment of more complex intracranial aneurysms including those with wide neck or unfavorable neck/sac ratio [2-12].

The major risk in the treatment of wide-necked aneurysms is the possibility of coil herniation through the broad neck into the parent vessel. In this circumstance, the use of a stent appears a valid option in the treatment of these lesions. However, despite advances in aneurismal endovascular therapy, complications related or associated with new techniques and devices can occur [7-12]. In stenting for intracranial aneurysms, the procedure-related morbidity rate has been reported from 7 to 9.3% and the mortality rate from 2.1 to 8.9% [7-12]. More frequent complications include thromboembolic events, dissection and delayed in-stent stenosis [8,9,11]. We report a case of prolapsed coil within the parent artery during a stent-assisted coil procedure. Coil herniation or fracture during wide-necked aneurysm embolization are more often reported in aneurismal endovascular procedures performed without stent-assistance [14-16]. Cases in which migration of part of a coil into the parent artery occurred after the procedure have also been described [17]. This post-procedural migration of coils could be either associated with wide neck aneurysms that are packed with undersized coils or have been tightly packed in the neck region with coils independent from the main coil basket [17].

Different strategies have been reported in case of peri-procedural complications such as prolapsed, unraveling or fractured coils. Previously, if coil migration or coil loops herniation occurred, the only way to manage this complication was administration of anticoagulants as heparin or coumadin combined with antiplatelet medications, occlusion of the parent blood vessel (after tolerance of the occlusion test) or, when feasible, surgical approach for coil removal.

The development of snare retrieval system represented a further adjunct available to rescue a loose coil in the arterial lumen [18]. Other options for coil retrieval as a dual guidewire technique have been proposed [19]. However, retrieval of a coil can be unfeasible or potentially hazardous especially if the coil is attached to the whole coil mass or, as observed in our case, tangled to the stent struts.

More recently, dedicated self expendable stents used for endovascular treatment of intracranial aneurysms have been proposed as a rescue technique after partial or complete coil herniation due to the possibility of coil trapping at the vessel wall [14-16]. Stenting has also been reported as a rescue procedure to prevent the migration into parental artery lumen of previously placed coils and to reduce the risk of thrombus formation [11]. In our case the retrieval of the coil appeared unfeasible and a second stent was proximally deployed in order to fix the migrated coil loops at the parent artery wall and prevent thrombo-embolic complications. Most reported cases of rescue stenting included stretched or fractured “linear” coils or fractured coils still remaining within the microcatheter [16].

In our case the prolapsed coil loops presented a “spring” like mass. Due to a favorable orientation of the coil loops, it was possible to place the microcatheter Vasco 21 (carrying the rescue stent) within the loops along the spring axis. Owing an important radial force for a self expandable stent [20], the Leo stent was able to spread some coil loops around the circumference of the stent and flatten the rest of the loose loops against the arterial wall. If the entire loop pack had been laterally trapped between the stent and the arterial wall, this asymmetrical mass could have been responsible for a decrease of the arterial lumen.

In conclusion, it should be kept in mind that the use of stents for intracranial aneurysms is a delicate procedure carrying the risk of endovascular complications and hazards related to plavix and aspirin administration for a long period. On the other hand, in order to avoid distal coil migration or vessel occlusion responsible for severe potential complication, the use of a rescue stent can be considered as an optional tool instead of other endovascular hazardous coil recovery techniques.

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